RESEARCH HIGHLIGHT

December 2008 Socio-economic Series 08-020

Breaking Ground: A Fused Grid Neighbourhood in Calgary

INTRODUCTION

CMHC began promoting the fused grid neighbourhood and district model to municipalities, developers and planners in 2003. In 2004, Calgary developer Genesis Land Development approached CMHC and requested collaboration on applying the model to a parcel of their land in northeast Calgary. The partnership resulted in a mutually satisfactory preliminary site plan that reflected fused grid principles.

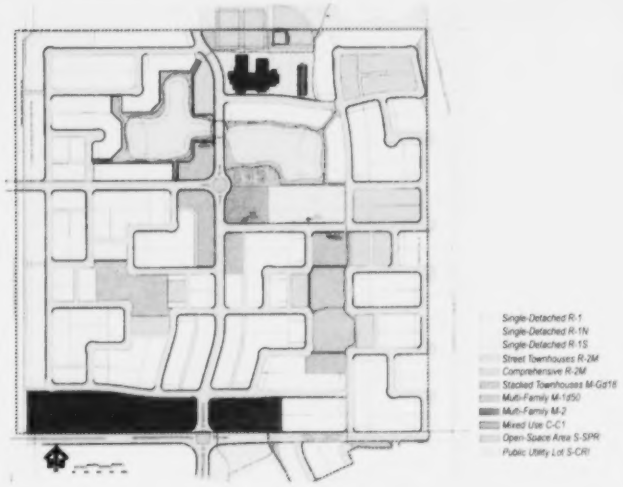

Figure 1 Saddleton street network and land use plan

In 2006, a planning consulting firm began preliminary design work on this 63 ha (160 acre) parcel, named "Saddleton," that formed part of the Saddle Ridge development (see figure 2). A central intent of the design was to achieve the efficiency, quality and reduced environmental impact that the fused grid model had demonstrated through research.

In applying the fused grid model to a specific site, Genesis and CMHC expected that its benefits for the municipality, the homebuyers and the environment could be demonstrated in practice. Through this demonstration, other municipalities and developers could be assured of its positive impacts and proceed to apply the model in their own districts.

This *Research Highlight* looks at the model's main characteristics; the design considerations and constraints in applying to a specific site; the process of reviews and approvals, the issues that emerge during the examination of innovative plans and the attributes of the final outcome in comparison to the original aims. (see figure 1)

THE FUSED GRID APPROACH

The fused grid model attempts to address contemporary issues that arise from street network patterns and the way they deal with cars and pedestrians.

Street patterns affect the environment and neighbourhood quality of life.

ENVIRONMENT

Street patterns consume land (up to 35 per cent in right-of-way in a district) and up to 20 per cent of municipal infrastructure budget for their placement and maintenance They also use bitumen, a dwindling resource.

Local streets are the bulk—over 70 per cent—of the entire network kilometers of a region. They add to the impermeable surface area, which has a negative impact on water quality. They contribute to urban heat, which affects demand for cooling energy. Street patterns can impede or enable walking and bicycling, which influences energy use for transport. They can restrict or accommodate traffic flow, which affects generation of greenhouse gases (GHG).

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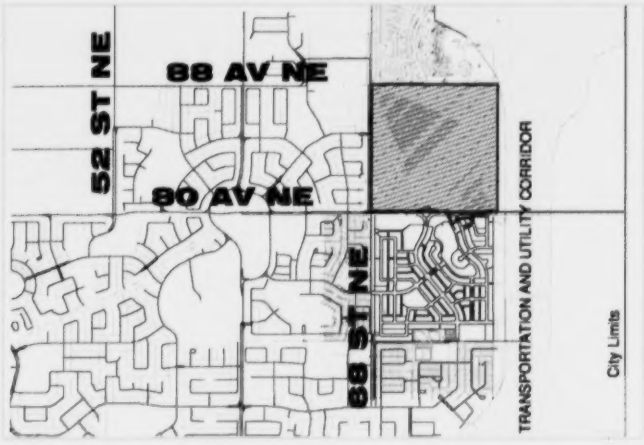

Figure 2 Shading shows location of Saddleton

QUALITY OF LIFE

Street patterns can reduce or increase the risk of injuries or fatal accidents; particularly for children and seniors. They can help increase tranquility in a neighbourhood and support social networking and children's play, which in turn reinforces a sense of security. They can reduce the noise intrusion and improve local air quality by managing traffic. They can make walking and biking pleasant or undesirable, which can favour or discourage an active lifestyle. Street patterns can support or undermine the viability of amenities required for daily routines by providing or denying convenient access to them.

In summary, a central problem faced by planners and municipal officials is that postwar street patterns inhibit walking and are disorienting and confusing to pedestrians as well as to drivers. They provide tranquility, safety and security at the expense of connectivity. They manage traffic well but often create bottlenecks at peak times in predictable locations.

Conversely, gridiron street patterns and the inheritance of a strictly pedestrian era, provide connectivity but at the expense of tranquility, safety and security. Without intensive management they often cause traffic congestion, which intensifies GHG emissions, air impurity, noise and driver frustration. They are the most land-consumptive and, consequently, the least environmentally benign.

THE FUSED GRID RESPONSE

The Fused Grid combines the connectivity and ease of orientation of the common street grid with the efficiency, safety and tranquility of recent suburban cul-de-sac and loop street patterns.* Each of these existing street patterns has positive attributes yet neither satisfies the entire set of environmental and quality of life criteria. The answer lies in their combination, which is embodied in the fused grid. It uses a continuous grid of roads for district and regional connectivity and a discontinuous grid of streets for neighbourhood safety. The discontinuous grid is supplemented by footpaths that connect all streets, turning a neighbourhood into a fully connected pedestrian realm. This combination of continuous and discontinuous street grids:

- Optimizes the use of land for streets;
- Secures tranquil and safe neighbourhoods;
- Increases the potential for social interaction;
- Reduces the amount of impermeable surfaces;
- Optimizes infrastructure;
- Assists district and regional traffic flow;
- Encourages walking while positively discouraging short-distance driving;
- Provides opportunities for rainwater management.

In summary, the fused grid balances the needs of the pedestrian and the motorist. It responds to the quest for economic efficiency and to the need for environmental stewardship.

DESIGN CONSIDERATIONS, GUIDING PRINCIPLES AND APPLYING THEM

Incorporating the attributes of the fused grid model was the overriding design direction for Saddleton. Translating to layout characteristics meant the following:

- Shifting most traffic to the perimeter of the 63 ha parcel and introducing internal collectors around the neighbourhoods leading directly to the surrounding major collectors;

* See Previous Research Highlights related to the Fused Grid model on last page

- Protecting neighbourhoods from through traffic;
- Increasing pedestrian connectivity, and making these routes direct and pleasant;
- Creating focal points for each neighbourhood (analogous to village squares);
- Maintaining a low ratio of street area to total land area;
- Displacing asphalt with open space where possible, thus meeting or exceeding the municipal requirements for open space dedication;
- Increasing the overall density of the neighbourhood by taking advantage of the relief provided by the open spaces;
- Providing meaningful destinations for people to walk to at the perimeter of neighbourhoods; and
- Using opportunities and techniques to manage stormwater.

These site plan techniques merged seamlessly with the City of Calgary's guiding principles for greenfield development.

GUIDING PRINCIPLES

In addition to the fused grid model's attributes, the Saddleton plan followed the sustainable guiding principles promoted by the City of Calgary and used in its evaluation of new suburban development. These stem from the City's intent to reduce the environmental impact of greenfield development and improve the quality of life for its residents:

1. ***Create walkable environments***—The Saddleton plan provides enhanced walkability through the fused grid network to places such as the neighbourhood core and open spaces. A comprehensive local and district pathway program provides direct linkages to key destinations within the area and to neighbouring areas. The core is a pleasant five-minute walk from any corner of all four neighbourhoods of the plan. Open spaces are found practically at the end of each block. Such quiet spaces and the connections between them provides opportunities for social interaction.

2. ***Provide a variety of transportation options***—Saddleton strives to achieve alternate forms of transportation through its fused grid design. Ultimately, two transit routes will be available within the neighbourhood. Future LRT (Light Rail Transit) is proposed in the Saddleton Centre located to the west. Sidewalks, pathways, and walkways have been incorporated to promote pedestrian movement throughout the community.

3. ***Use green infrastructure and buildings***—Low-impact development (LID) stormwater management techniques incorporated in the Saddleton plan reduce pollutant-loading on downstream areas. These techniques also reduce irrigation requirements and more closely replicate pre-development run-off regimes. The rain garden stormwater system also offers the opportunity to create interpretive signage and programs to educate area residents about the importance of water conservation and management. This system has the cost advantage of combining three functions in one: open space / recreation, pathway system routes, and stormwater management. (see figure 3)

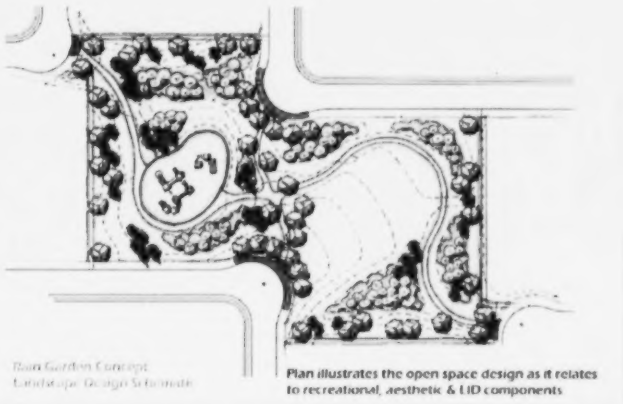
Rain Garden Concept
Landscape Design Schematic
Plan illustrates the open space design as it relates to recreational, aesthetic & LID components

Figure 3 An open space with a triple function: recreation, pathway node and rainwater filtration

4. ***Preserve open space, agricultural land, natural beauty and critical environmental areas***—Saddleton has been designed to work with the natural contours of the land. Natural lows have become enhanced public open spaces. The plan incorporates LID techniques for rainwater and stormwater management. This mimics the natural water cycle of the land, using design features that store, infiltrate, evaporate and detain runoff and soil moisture.

   This approach not only reduces the impact on the scale of the infrastructure needed within the proposed subdivision but also lessens the impact on downstream receiving systems. Further, it enhances those lands already set aside as green space by making use of surface runoff and improving the quality of the environment for future residents and visitors to the area. It may also reduce the amount of private garden irrigation because of the prolonged retention of soil moisture.

5. *Create a range of housing opportunities and choices*—The Saddleton plan consists of diverse housing types to meet various levels of affordability and creates housing opportunities for all age groups. Tenure is based on fee simple and condominium ownership. Low density areas may or may not have alleys. Medium density areas are made up of apartments and townhouses. Secondary suites are encouraged throughout the low density areas.

6. *Support compact development*—Saddleton will support compact development. The proposed density is between 25.8 and 30 units per hectare (10.5 and 12.1 units per acre). These densities are about 50 per cent higher than the average of five to six units per acre in older conventional subdivisions. The higher density area is concentrated along the transit routes and within the neighbourhood core, all within the vicinity of community amenities and local commercial.

7. *Mix land uses*—The plan includes a broad mix of uses. Proposed general uses include local commercial, recreation, institutional and residential. Its overall density is expected to ensure the viability of the proposed community amenities.

8. *Foster distinct, attractive communities with a strong sense of place*—The Saddleton district has been laid out as four distinct neighbourhoods (quadrants), all containing a centralized open space. There is excellent pedestrian access between each of the quadrants, which creates a walkable, attractive pedestrian environment. A centralized community core includes local commercial, higher densities, a storm pond and children's playground. These amenities provide a gathering place and central hub for the community, which reinforces a sense of place and communal attachment.

SITE CONSTRAINTS

Constraints on site affected the optimal output of the fused grid model. Pre-development conditions to the north accommodated only one road connection, also a future transit route. Also in the north, additional land was required to complete the configuration of a joint school site.

Running across the south boundary of the plan area is 80th Avenue NE, which has limited road connections because of the intersection spacing required for this type of road standard. To the west, the existing infrastructure was limited to one collector road/future transit route, with shared sidewalks on each side. To the east, land not owned by Genesis[1] created design inefficiencies. Road connectivity had to be on the Genesis property exclusively. As well, no road–pedestrian ties were permitted further east due to a future ring road—transportation and utility corridor. These site conditions limit the extent to which a district is connected to adjacent districts and, consequently, an optimal traffic flow management and freedom of pedestrian and bicycle movement.

Through the initial site reconnaissance, a Class II–III supporting wetland was identified in the north half of the plan area. Its location would have greatly constrained the application of the fused-grid model. Under the policies of the Calgary Wetland Conservation Plan, if a wetland is deemed less significant by its isolated state, options are available to the developer.

One is to create an emergent wetland in conjunction with the storm pond design, or provide monetary compensation based on an established ratio, or a combination of both. This was the option chosen in Saddleton. Consequently, the wetland aspect was combined with the stormwater design consideration, and therefore it became a layout advantage.

PROCESS AND LESSONS

The following steps illustrate how the plan progressed from its inception to approval:

- An invitation was made to City staff on behalf of Genesis, to a presentation by Canada Mortgage and Housing Corporation (CMHC), introducing the fused-grid model (March 2006).
- Preparation of a plan was started for the Saddleton property by Genesis and its consultants.
- A preliminary meeting was held with City officials to introduce the plan, in order to receive initial feedback (January 2007), that was followed by refinements to the plan.
- An official, pre-application meeting took place with City administration (March 2007), which was followed by further refinements based on written comments.

1 A shadow plan was required on this landowner's property in order to prove that their land was not impeded by the Saddleton design.

- Official, full submission of the application was made to the City (June 2007), followed by a one-month review period.
- A public open house was held (September 2007).
- Resolution of outstanding issues occurred, resulting in additional refinements to the plan (fall 2007-winter 2008).
- Presentation was made at Calgary Planning Commission for a decision on the plan and a recommendation to City Council on its land uses (March 2008).
- Advertisement of the proposed land uses.
- Public hearing of City Council was held for a final decision (April 2008) that resulted in the approval of the development plan

COMMENTS FROM CITY DEPARTMENTS AND RESOLUTIONS

The City of Calgary is the designated approving authority in considering the Saddleton plan. While Calgary Planning Commission addresses the conditions of development, it is City Council that considers the proposed land uses, eventually creating the basis of the built-form envisioned by the design considerations.

Many comments were received by the City as a result of this proposal and a few, identified below, were seen as having challenged Genesis' guiding principles.

Path connections to a future linear open space (68th Street NE)

At the pre-application presentation of the plan to the City, three pedestrian linkages—two linear green spaces and a walkway—were proposed to provide connectivity to a future linear open space to the west.

The City (Parks) requested these be eliminated as part of the Parks' policy to promote larger park spaces with multi-functional purposes. Genesis chose to comply with this request in the official submission.

Another linear park was kept in the plan, linking two public roads, and was later deleted through the official circulation process. These linkages were consistent with the principle of maintaining high pedestrian connectivity and with the City's guidelines for creating walkable communities. Parks, however saw the larger park policy as overriding the walkability guideline and could not accommodate the developer.

Transit Coverage

Calgary's Transit Friendly Design Guidelines specify that future residents should be located within specific[2] distances from a transit service (bus or train). While these guidelines were met in the Saddleton plan, Calgary Transit indicated that another route would be required to improve coverage, in effect, increase the percentages beyond the guidelines.

In order to accommodate this requirement, an additional 650 m (2,100 feet) of a wider road standard would have to be constructed as bus service can only occur on roads that are collectors or larger. This issue was elevated to a higher decision-making body, with Genesis providing the argument that the guidelines had been met, and in fact exceeded. In this case, the additional transit route was eliminated and the road sizes remained as proposed. It is worth noting that, if the additional bus route (and widening) had occurred, it would have meant higher costs and lower density—both of which would have affected housing affordability.

Table 1 Comparative values for land use elements in similar Calgary developments. (GDA=Gross Development Area and UPA=Units per Acre)

	Saddleton	Mahogany	Walden	Garrison Woods
	New subdivisions			Built up
Open space (per cent of GDA)	11	9.4	12.3	10
Commercial (per cent of GDA)	1	3.2	3.1	3
Residential density (UPA-range)	10.5–12.1	10.1–11.1	8.6–9.4	11.1–13.1

2 70 per cent of all residents to be located within 300 m (984 ft.) and 95 per cent to be located within 400 m (1,300 ft.) walking distance of a transit stop

Wayfinding (Calgary Planning Commission)

A comment was made by a Planning Commission member about the impact of the Saddleton layout on wayfinding, that is, locating an address.[3] The road design appeared circuitous and could lead to difficulty in locating an address. One suggestion was to convert a linear open space into a public road to provide more direct vehicular movement. This would have defeated the design principle of providing excellent pedestrian connectivity by using linear parks. Municipal service providers such as fire, police and emergency medical services had no concerns.

FINAL PLAN ATTRIBUTES AND BENEFITS

Despite the changes during the reviews, the plan kept most of its original design intentions intact, barring the site limitations and their effect.

A plethora of connections through linear parks, walkways and street sidewalks was intended and realized to create an exceptional, walkable matrix for the neighbourhood, not just internally but externally to existing developments in the north, south and west.

A healthy range of housing choice was a strong factor in the design of Saddleton.

Existing retail to the south provided the impetus to encompass it with medium-density (apartments) residential located along the south portion of the neighbourhood. Higher density housing, including townhouses and apartments, was introduced along the transit routes and surrounding the large public park spaces. The overall density for Saddleton remained in the range of between 25.8 and 30 units per ha (10.5 and 12.1 units per acre). (Table 1)

A neighbourhood core area comprising some local retail, public open space, a roundabout, the convergence of multiple transit routes and a storm pond also afforded the opportunity for higher density residential buildings.

Low Impact Development fit well with the model layout, which included open spaces as essential components of LIDs:

- Rain gardens were introduced in the two larger parks in the southern half of the plan. These are designed to receive, capture, and store rainfall and surface runoff from surrounding areas. Plants are allowed to thrive where a greater organic soil mix is concentrated.
- New road design features were developed to augment the rain garden concept, whereby asphalt runoff was chanelled to the rain gardens through a combination of depressed curbs and turf-drainage swales.
- Innovative rear yard drainage, where site grading permits, allowed each residential lot to contain an increased root zone profile by providing extra depths of loam and topsoil. Storm runoff then permeates the subsurface more rapidly, which reduces the size needed for storm pipes and potentially eliminates some.

Green streets, essentially houses fronting onto linear park spaces, were introduced not only to offer up another housing type, but to improve on walkability opportunities.

Figure 4 Network of paths to which pedestrians have access

3 "Wayfinding" is a term coined by urban planner Kevin A. Lynch, who defined wayfinding as "a consistent use and organization of definite sensory cues from the external environment." Environmental psychologist Romedi Passini expanded the concept to include signage and other graphic communication, clues inherent in the building's spatial grammar, logical space planning, audible communication, tactile elements, and provision for special-needs users.

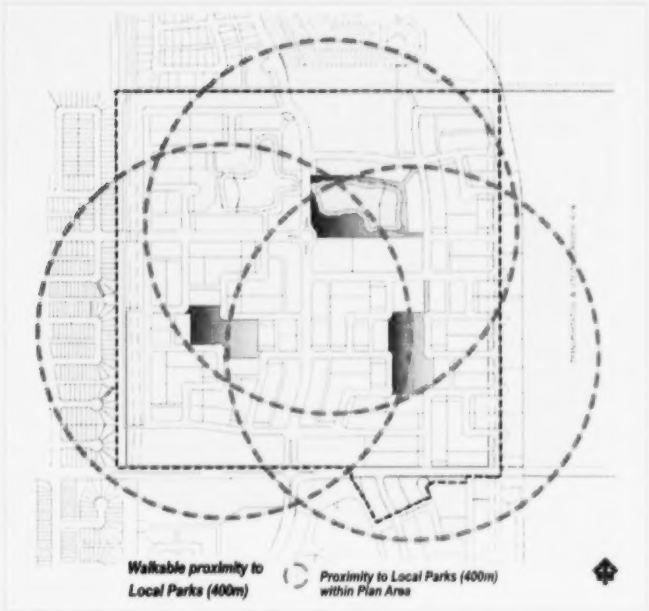

Figure 5 Parks as neighbourhood nodes and a five-minute walk radius from each

BENEFITS

Economics play a significant role in community design, as municipalities strive to maintain low taxes. (Calgary has one of the lowest tax rates in Canada.).

Specifically, road configurations and designs need to be rethought in order to reduce their footprint within the community and their costs. A more customized approach to roads would evaluate the functional purpose of each street and then design them accordingly.

As well, in order to make neighbourhoods attractive places, a pleasant walking environment might include "greening up" the space. Devising ways to separate the pedestrian from the automobile will increase the appeal of the area and entice people to walk more. These need not be limited to separate walks but may include pathways within green spaces. The combination of functions, such as is achieved by the open spaces in Saddleton, offers economies worth achieving. (see figure 4)

For a walkable neighbourhood or community to function properly, network connections are necessary with local destinations being a prerequisite. Whether it is to shop, work, or play, paths to these destinations need to be available for each purpose. In its design, Saddleton has many local destination points—the neighbourhood core with retail shops and services, neighbourhood parks in each quadrant including a future school site, and the larger shopping area located to the south.

Table 2 Fused grid elements in Saddleton and how they respond to issues

Initiative or Solution	Addresses
Traffic control and calming	Noise pollution Air quality Stress (for both drivers and pedestrians)
Alternative street design (Fused Grid)	Pedestrian and cyclist safety Noise pollution Air quality Water quality (more permeable area) Physical health (encourages walking) Mental health/social development
Green space, water retention	Noise pollution Air quality Water quality Stress and mental health
Optimal development density and mixed use	Air quality Fewer car trips Physical health Encourages walking
Bicycle/pedestrian infrastructure	Air quality (fewer car tips) Pedestrian and cyclist safety Noise pollution (traffic reduction) Physical and mental health

While the Saddleton fused grid plan can only be evaluated from the desktop at this time, its attributes are known, from other research, to be of value to homebuyers. Once built, the long-term benefits to the neighbourhood will be noticed through healthier choices, such as walking, jogging, or cycling. Providing densities and a variety of land uses will create the synergy to encourage a lifestyle that is more sustainable and pleasurable. It can be viewed as a pioneering application that can generate additional knowledge about society's response to new configurations of their familiar daily settings. (see figure 5)

CONCLUSION—WHY THE FUSED GRID IN SADDLETON?

Planners and municipal officials today face the daunting challenge of reducing the impact of development on the environment while maintaining or increasing the quality of life for residents. With an economy running almost entirely on carbon-based fuels and demanding an efficient transportation system, the challenge of reducing emissions appears almost unmanageable.

However, solutions continue to emerge in every field that achieve incremental efficiencies that do not require changes in lifestyle. (For example, hybrid cars, and fluorescent bulbs.)

One such solution in planning neighbourhoods and districts is the fused grid model. As Table 2 shows, its elements that have been incorporated into the Saddleton plan respond to a number of concerns. The model intrinsically gives priority to pedestrians while creating a pleasant milieu for daily living. This emphasis on active transportation along with the infrastructure economies and the natural way of handling storm water makes it a fitting response to current environmental and health issues.

PREVIOUS RESEARCH HIGHLIGHTS RELATED TO THE FUSED GRID MODEL

Residential Street Pattern Design (order #64286)

Applying the Fused Grid in Strarford, Ontario (order #63760)

Giving Pedestrians an Edge - Using Street layout to influence Transportation Choice (order #66086)

Taming the flow: Better Traffic and Safer Neighbourhoods (order #66071)

A Plan for Rainy Days: Water Runoff and Site Planning (order #65658)

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